

Claims

1. A device for measuring an object to be measured in a sample which comprises a support, sample addition site (S) and a detection site (Q), said sample addition site and said detection site being on the support,

said support allowing the object to be measured to move by the capillary flow of a developing liquid,

said detection site having a piezoelectric vibrator sandwiched between two electrodes,

said piezoelectric vibrator having a trapper A (c1) immobilized thereon, or an analogue of the object to be measured (c1') immobilized thereon, and

said support further comprising a binder retaining site (BR) where a binder (b1) is retained therein so that it is movable by the capillary flow of the developing liquid.

2. The device according to claim 1, wherein the binder retaining site is provided between the sample addition site and the detection site.

3. The device according to claim 1, wherein the binder retaining site is provided on the opposite side of the sample addition site with the detection site being interposed therebetween.

4. A device for measuring an object to be measured

in a sample which comprises a support, sample addition site (S) and a detection site (Q), said sample addition site and said detection site being on the support,

said support allowing the object to be measured to move by the capillary flow of a developing liquid,

said detection site having a piezoelectric vibrator sandwiched between two electrodes,

said piezoelectric vibrator having a trapper A (c1) immobilized thereon that binds to the object to be measured, or a trapper B (c3) immobilized thereon that binds to a complex of a binder with a labeled analogue of the object to be measured or the object to be measured and to a complex of a labeled binder with the object to be measured or the analogue of the object to be measured,

said support further comprising a binder retaining site (BR) where the binder (b1) is retained so that it is movable by the capillary flow of the developing liquid, and

said support further comprising an analogue of the object to be measured immobilizing site (DF) where the analogue of the object to be measured (b5) is immobilized between the binder retaining site and the detection site so that it is not moved by the capillary flow of the developing liquid, or an analogue of the object to be measured retaining site (DR) where the analogue of the

object to be measured (b5) is retained on the support so that it is movable by the capillary flow of the developing liquid.

5. The device according to any one of claims 1 to 4, wherein the binder is labeled.

6. A device for measuring an object to be measured in a sample which comprises a support, sample addition site (S) and a detection site (Q), said sample addition site and said detection site being on the support, said support allowing the object to be measured to move by the capillary flow of a developing liquid,

said detection site having a piezoelectric vibrator sandwiched between two electrodes, the piezoelectric vibrator having a binder (c2) immobilized thereon, and

said support further comprising an analogue of the object to be measured retaining site (DR) where the analogue of the object to be measured (b2) is retained so that it is movable by the capillary flow of the developing liquid.

7. The device according to claim 6, wherein the analogue of the object to be measured retaining site is provided between the sample addition site and the detection site.

8. The device according to claim 6, wherein the analogue of the object to be measured retaining site is

provided on the opposite side of the sample addition site with the detection site being interposed therebetween.

9. A device for measuring an object to be measured in a sample which comprises a support, sample addition site (S) and a detection site (Q), said sample addition site and said detection site being on the support,

said support allowing the object to be measured to move by the capillary flow of a developing liquid,

said detection site having a piezoelectric vibrator sandwiched between two electrodes, the piezoelectric vibrator having a trapper B (c3) immobilized thereon, and

said support further comprising an analogue of the object to be measured retaining site (DR) where an analogue of the object to be measured (b2) is retained so that it is movable by the capillary flow of the developing liquid, and a binder retaining site (BR) where a binder (b3) is retained so that it is movable by the capillary flow of the developing liquid.

10. A device for measuring an object to be measured in a sample which comprises a support, sample addition site (S) and a detection site (Q), said sample addition site and said detection site being on the support,

said support allowing the object to be measured to move by the capillary flow of a developing liquid,

said detection site having a piezoelectric vibrator

sandwiched between two electrodes, the piezoelectric vibrator having a binder (c2) immobilized thereon that binds to the object to be measured,

said support further comprising an analogue of the object to be measured retaining site (DR) where an analogue of the object to be measured (b2) is retained so that it is movable by the capillary flow of the developing liquid, and

said support further comprising a binder immobilizing site (BF) where a binder (b4) is immobilized on the support between the analogue of the object to be measured retaining site and the detection site so that it is not movable by the capillary flow of the developing liquid.

11. The device according to any one of claims 6 to 10, wherein the analogue of the object to be measured is labeled.

12. The device according to any one of claims 5 or 11, wherein the label is an insoluble particle.

13. The device according to claim 12, wherein the insoluble particle is a metal colloid or latex.

14. A device for measuring an object to be measured in a sample which comprises a support, sample addition site (S) and a detection site (Q), said sample addition site and said detection site being on the support,

said support allowing the object to be measured to move by the capillary flow of a developing liquid,

said detection site having a piezoelectric vibrator sandwiched between two electrodes, and

said piezoelectric vibrator having a trapper A (c1), an analogue of the object to be measured (c1'), a binder (c2) or a trapper B (c3).

15. The device according to any one of claims 1 to 14, which further comprises a developer absorbing site (d).

16. The device according to any one of claims 1 to 15, wherein the detection site has another piezoelectric vibrator which is sandwiched between two electrodes and on which none of the trapper A (c1), the analogue of the object to be measured (c1'), the binder (c2) and the trapper B (c3) are immobilized, in addition to the piezoelectric vibrator which is sandwiched between two electrodes and on which the trapper A (c1), the analogue of the object to be measured (c1'), the binder (c2) or the trapper B (c3) is immobilized.

17. The device according to any one of claims 1 to 16, wherein the piezoelectric vibrator is a quartz oscillator.

18. An apparatus for measuring an object to be measured which comprises the device according to any one

of claims 1 to 17, a frequency measuring circuit which measures the frequency of vibration of the piezoelectric vibrator and which is connected to the electrode of the piezoelectric vibrator of the device, and a concentration arithmetic circuit which calculates a concentration of the object to be measured based on the frequency and which is connected to the frequency measuring circuit.

19. A method for quantitatively determining an object to be measured in a sample which comprises the steps of:

preparing a piezoelectric vibrator having a substance immobilized thereon, said substance being a trapper A (c1) or an analogue of the object to be measured (c1'),

supplying the sample and a binder to the substance through a support where the object to be measured and the binder are movable by the capillary flow of the developing liquid,

allowing the object to be measured in the sample to bind specifically to the substance immobilized on the piezoelectric vibrator, and

quantitatively determining alteration in frequency of a piezoelectric vibrator generated by the specific binding with the substance immobilized on the piezoelectric vibrator.

20. The method according to claim 19, wherein the sample and the binder are supplied by the capillary flow in the same direction toward the trapper A or the analogue of the object to be measured.

21. The method according to claim 19, wherein the sample and the binder are supplied by the capillary flow in the reverse direction with respect to the trapper A or the analogue of the object to be measured.

22. A method for quantitatively determining an object to be measured in a sample which comprises the steps of:

preparing a piezoelectric vibrator having a substance immobilized thereon, said substance being a trapper A (c1) or a trapper B (c3),

supplying the sample and a binder to the substance through a support where the object to be measured and the binder are movable by the capillary flow of the developing liquid, but where an analogue of the object to be measured (b5) is immobilized so that it is not movable by the capillary flow of the developing liquid,

allowing the object to be measured in the sample to bind specifically to the substance immobilized on the piezoelectric vibrator, and

quantitatively determining alteration in frequency of a piezoelectric vibrator generated by the specific

binding with the substance immobilized on the piezoelectric vibrator.

23. A method for quantitatively determining an object to be measured in a sample which comprises the steps of:

preparing a piezoelectric vibrator having a substance immobilized thereon, said substance being a trapper A (c1) or an analogue of the object to be measured (c1'),

supplying the sample and a binder to the substance through a support where the object to be measured and the binder are movable by the capillary flow of the developing liquid,

allowing the object to be measured in the sample to bind specifically to the substance immobilized on the piezoelectric vibrator, and

quantitatively determining alteration in frequency of a piezoelectric vibrator generated by the specific binding with the substance immobilized on the piezoelectric vibrator.

24. The method according to any one of claims 17 to 23, wherein the binder is labeled.

25. A method for quantitatively determining an object to be measured in a sample which comprises the steps of:

preparing a piezoelectric vibrator having a substance immobilized thereon, said substance being a binder (c2),

supplying the sample and an analogue of the object to be measured to the substance through a support where the object to be measured and the analogue of the object to be measured are movable by the capillary flow of the developing liquid,

allowing the object to be measured in the sample to bind specifically to the substance immobilized on the piezoelectric vibrator, and

quantitatively determining alteration in frequency of a piezoelectric vibrator generated by the specific binding with the substance immobilized on the piezoelectric vibrator.

26. The method according to claim 25, wherein the sample and the analogue of the object to be measured are supplied by the capillary flow in the same direction toward the binder.

27. The method according to claim 25, wherein the sample and the analogue of the object to be measured are supplied by the capillary flow in the reverse direction with respect to the binder.

28. A method for quantitatively determining an object to be measured in a sample which comprises the

steps of:

preparing a piezoelectric vibrator having a substance immobilized thereon, said substance being a trapper B (c3),

supplying the sample, an analogue of the object to be measured (b2) and a binder (c3) to the substance through a support where the object to be measured, the analogue of the object to be measured (b2) and the binder (c3) are movable by the capillary flow of the developing liquid,

allowing the object to be measured in the sample to bind specifically to the substance immobilized on the piezoelectric vibrator, and

quantitatively determining alteration in frequency of a piezoelectric vibrator generated by the specific binding with the substance immobilized on the piezoelectric vibrator.

29. A method for quantitatively determining an object to be measured in a sample which comprises the steps of:

preparing a piezoelectric vibrator having a substance immobilized thereon, said substance being a binder (c2),

supplying the sample and an analogue of the object to be measured to the substance through a support where

the object to be measured and the analogue of the object to be measured are movable by the capillary flow of the developing liquid, but where a binder (b4) is immobilized so that it is not movable by the capillary flow of the developing liquid,

allowing the object to be measured in the sample to bind specifically to the substance immobilized on the piezoelectric vibrator, and

quantitatively determining alteration in frequency of a piezoelectric vibrator generated by the specific binding with the substance immobilized on the piezoelectric vibrator.

30. The method according to any one of claims 25 to 29, wherein the analogue of the object to be measured is a labeled substance.

31. The method according to claims 24 or 30, wherein the label is an insoluble particle.

32. The method according to claim 31, wherein the insoluble particle is a metal colloid or latex.

33. A method for quantitatively determining an object to be measured in a sample which comprises the steps of:

preparing a piezoelectric vibrator having a substance immobilized thereon, said substance being a trapper A (c1),

supplying the sample to the substance through a support where the object to be measured is movable by the capillary flow of the developing liquid,

allowing the object to be measured in the sample to bind specifically to the substance immobilized on the piezoelectric vibrator, and

quantitatively determining alteration in frequency of a piezoelectric vibrator generated by the specific binding with the substance immobilized on the piezoelectric vibrator.

34. The method according to any one of claims 17 to 29, wherein a second piezoelectric vibrator on which none of the trapper A (c1), the analogue of the object to be measured (c1'), the binder (c2) and the trapper B (c3) are immobilized is used, the method further comprising supplying the sample to a first piezoelectric vibrator on which the trapper A (c1), the analogue of the object to be measured (c1'), the binder (c2) or the trapper B (c3) is immobilized and to the second piezoelectric vibrator, and using the second frequency as a control.

35. The method according to any one of claims 19 to 34, wherein the piezoelectric vibrator is a quartz oscillator.